

ganic always greatly exceeds the mineral matter. As I have before frequently said, though the mineral matter be so small in proportion to the organic, it is not on that account of less importance; and though the quantity be small in reference to the organic matter, yet when we consider the quantity removed by a crop when exported from an acre, it assumes a high degree of importance. The analysis of 62 specimens of wheat gives, on an average, 1.67 per cent. of mineral matter. A bushel of *wheat*, weighing 61 pounds, will remove on the average exactly one pound of mineral matter. Twenty bushels will remove twenty pounds; a yield of forty acres carries away 800 pounds (every time that it is in cultivation) of substances vitally necessary to the growth of wheat, and which can in no way be replaced save by manure containing the elements carried off, or by the slow degradation* of the soil: but the soil sometimes has not the substance needed in sufficient abundance to supply the crop. Manures, then, must be looked to; but what manures? not those of which the soil has the materials already, but those which it has not; or which if it has, not in sufficient quantity for the use of the plant. Here at once is a peremptory necessity for analysis; here at once is a peremptory necessity for knowledge and certainty, instead of ignorance and speculation.

But to return. At every rotation of a forty acre field, 800 pounds of food is removed from the storehouse of the wheat plant; in twenty years, with a four year rotation, there departs 4,000 pounds. Does not this explain facts of which unfortunately your honorable body and the State at large are too familiar? These facts are the deterioration in the value of lands, the loss to the state from deficient production of crops, and the far greater loss in the services of the best and most industrious of her working population, her honor, her defence, her pride, who are obliged to leave their homes, and seek elsewhere that support which the soil of their childhood denies to them.

Does not this explain how for the first few years of a virgin soil fine crops are produced, these become so small at last as not to remunerate for their cultivation; a crop requiring less strength in the land is next substituted, and so on, until scarcely any crop at all will be produced. When those soils are to be improved, shall their owners apply manures in the dark, and walk wearily along the path of experiment, or shall they be furnished with those lights which will at once give them strength, energy and activity, because certainty and knowledge?

* In speaking of rocks, soils, &c., the term *degradation* means the breaking of them up into smaller particles, by which they assume a form which renders them more easily soluble. This is effected by various agencies, alternate freezing and thawing, cultivation, application of lime, &c.